

ANTHRAX

PUBLIC HEALTH AND WELFARE TECHNICAL BULLETIN

PH&W GHQ SCAP APO 500

March 1947

ARMY  
MEDICAL  
OCT 20 1948  
LIBRARY

1. Definition -- Anthrax (Spleenic Fever) is an acute septicemia (bacteremia) caused by *Bacillus anthracis* and characterized by enlargement of the spleen.

2. History -- The history of anthrax is marked by three events of great importance: first, it was one of the first scourges to be described in ancient literature; secondly, its description by Koch in 1876 marks the beginning of modern bacteriology; and third, when Pasteur immunized animals against anthrax in 1881, this was the first example of artificial immunization against disease by means of an attenuated culture of the specific cause of that disease.

3. Distribution -- This is general throughout the world, especially in Russia, Asia, Japan, Africa, the tropics and all warm climates. It affects chiefly herbivora--cattle, sheep and horses, less often and less severely, swine, dogs and chickens. It is sporadic in man as a local affection of the skin, the lungs, or the intestines.

4. Etiology -- *Bacillus Anthracis*--The vegetative form of this microorganism is found in the blood of advanced cases, and in the tissues of those that have recently died. It is a non-motile gram positive rod, 2-4 microns long, arranged in short chains in the tissues and encapsulated. The organism is readily found in stained smears from the tissue or blood. The spore form exists permanently in the soil, having originated from bacilli dropped in the excretions of either the sick or dead. They form in the feces of the sick, but sporulation occurs only in the presence of air. Under favorable conditions of moisture and temperature, propagation continues in the soil. Spores are carried in hides, brushes, water, fodder, grain, vaccine, bonemeal, bones, and other animal products.

5. Modes of Infection

a. Soil Infection -- Once the soil becomes infected it remains so for years. New invasions result from inundation of pastures with tannery refuse, from improper disposal of anthrax cadavers, and from flesh-eating animals and birds that carry the germs in feces or upon the feet. Spores are not found in the buried carcasses and the bacilli is soon destroyed by decomposition of the tissues.

b. Ingestion -- Cattle and sheep usually contract the disease from infected pastures and streams. Fodder and grain may also carry the causative organism and occasionally cause a sporadic stable infection.



Swine, dogs, cats and chickens sicken after eating anthrax cadavers, licking infected blood and hides, or any object that has recently been contaminated. Ingestion is favored by prolonged drought combined with extreme heat, conditions which lead to drinking of polluted water and close grazing.

c. Biting Insects --Horses are often inoculated in the skin from blood-sucking flies and mosquitoes, and cattle are likewise exposed.

d. Wound Infection --Contaminated hands and instruments may inoculate an operative wound in animals.

e. Vaccination Anthrax --In virulent outbreaks any biological product may respond unfavorably when used for vaccination in herds that are exposed. Vaccinations at the height of an intense development of disease, or repeated vaccination at brief intervals during the outbreak may be followed by deaths from anthrax.

f. Human Infection --It is largely an occupational disease occurring among those who handle hides, hair, wool and bones, or those who come in contact with anthrax cadavers, such as farmers, butchers and veterinarians. Cheap shaving brushes are an occasional source of infection.

6. Morbid Anatomy --Rigor mortis fails and the carcass rapidly undergoes decomposition. The skin sometimes presents edematous swellings or necrotic patches, but usually it is normal. The body openings often exude dark-red blood. Beneath the skin, the serous and mucous membranes and in the muscles, extensive hemorrhages are frequent. Body cavities contain blood-stained serum. The spleen is greatly enlarged, hemorrhagic, and degenerated. The liver and kidneys are swollen congested and soft. Hemorrhagic inflammation is nearly always present in the duodenum and the abomasum. The blood fails to clot. The lungs are congested and the respiratory mucosa is heavily sprinkled with petechiae. In general, the post-mortem changes of acute septicemia and toxemia are similar, regardless of the cause.

7. Symptoms --The disease occurs most frequently in summer months in pastured animals, but often it attacks stabled animals. The period of incubation under natural conditions is not readily determined. After ingestion it is probably one or two weeks; after bites and wounds it may be less.

## 8. Form of Anthrax

a. Peracute Anthrax --A rapid fatal general infection of sheep, a frequent form in cattle and occasional in horses. Bloody foam is often expelled from the mouth and nostrils, and blood from the anus and vulva. This is known as the apoplectic form and is the most prevalent in the beginning of an outbreak.

b. Acute Anthrax --A general infection ushered in with a temperature of 105 to 107 degrees F. (40 to 41 degrees C.) The onset is sudden with marked depression, congestion of the visible mucosa with some hemorrhages, muscular tremors, cessation of the milk secretion, a rapid pulse,



and a high fever. Other manifestations vary according to the intensity of the invasion in different parts of the body. Necrosis and inflammatory edema of the skin, enteritis with bloody diarrhea, hemoglobinuria from kidneys and swollen lymph glands. The terminal symptoms are those of the peracute type with normal or abnormal temperature. The course is from one to two days, sometimes longer.

- (1) In Cattle --The course is somewhat shorter, twelve to twenty-four hours, with swelling at the throat, neck, chest, flanks or back. But enteritis with bloody diarrhea is the usual localization.
- (2) In Horses --Swelling of the mammary glands and the sheath with a normal to high temperature of 106 degrees F. (41 degrees C.) On second day, the swelling becomes extensive, cool and painless, appetite poor and the breathing fast, while the temperature drops to 102 or 104 degrees F. (39 to 40 degrees C.) As death approaches, colicky pains often appear, the temperature falls below normal and death occurs suddenly usually on the third day. When swellings develop in the pharyngeal region (edema of the glottis) inspiratory dyspnea develops early. Swellings similarly occur in the lower abdominal and thoracic area. When anthrax appears in horses it often attacks only one or two individuals on a farm, a suggestion that it is carried by biting flies.
- (3) In Swine --The chief affection is an inflammatory edema of the throat (edema of the glottis) that soon leads to death from suffocation and septicemia. Bloody froth on the lips, swelling of the throat and face symptoms of choke and petechial hemorrhages of the skin and other symptoms of a general infection along with some swellings over the chest and abdomen. Death usually occurs in from 12 to 36 hours but recovery is occasional. While swine are less susceptible than cattle, they are easily infected from eating contaminated refuse, and the disease in swine is limited almost entirely to farms where other species have died of anthrax.

c. Subacute Anthrax --This term applies to convalescents from the latter period of an outbreak and to an animal that possesses a natural resistance. One may expect occasionally to find individuals in which the disease is atypical with respect to both course and form.

9. Prognosis --In heavily infected districts, and under exposure to swarms of flies, the disease is highly destructive to all species of domestic animals. When the infection is less abundant and less virulent only a small part of a herd suffers, but the mortality in the sick is from 90 to 100 per cent. Recoveries are mainly confined to local external infections, and the last to be attacked in an enzootic.



10. Diagnosis --Sudden deaths in pastured stock may be caused by other acute infections--blackleg, hemorrhagic septicemia, by lightning stroke, and by lead or other poisoning. Cattle not infrequently die at pasture, especially in the spring, without a diagnosis being made even when the cases are thoroughly investigated. Recognition depends largely on finding the bacillus in the blood of the sick or the tissues of the fresh cadaver. Because of the importance of making an early diagnosis, smears from the blood before death are preferable. In no other disease are similar bacteria found in the circulating blood. Yet anthrax bacilli may not be found in the circulating blood until shortly before death. As a rule, however, they may be easily demonstrated from cutaneous hemorrhages immediately after death. If doubt exists a mouse or guinea pig should be inoculated. Any acute, undiagnosed, febrile disease occurring in the summer suggests anthrax. Autopsy lesions of special significance are: failure of rigor mortis, bloody foam at the body openings, hemorrhages throughout the body and enlargement of the spleen. For laboratory diagnosis send fresh iced blood, heart, spleen, liver, or the ear from the lower side of the body. A negative report is not always conclusive, for the bacilli die rapidly in putrefactive tissues and they may succumb in transit.

11. Immunization --Vaccination against this disease is of some value, although not entirely so. In general there are three forms of immunizing agents:

a. The anti-anthrax serum used for curative purposes (its protective power lasts for about ten days).

b. Anthrax bacterin which may safely and quite effectively be used for immunizing purposes in herds when there are no ailing animals, (it protects for a period of approximately one year).

c. Attenuated anthrax-spore vaccine which should be used only in herds where the disease has made its appearance and when the occupied pastures are known to be contaminated. This vaccine is simply greatly weakened or attenuated anthrax spores, and under proper conditions might lose its attenuation to become fully virulent so as to be a means of contaminating previously anthrax clean pastures. (It is the most potent of the anthrax vaccines).

12. Sanitation --To prevent soil contamination all cadavers should be deeply buried or burned without removing the skin, and material that drops from the body openings or that has been in contact with virus should be destroyed by disinfection or burning. Suspected hides or animal products require thorough disinfection for the protection of both men and animals. Infected premises should be disinfected and quarantined to prevent the removal of infected cattle. As far as possible the sick should be segregated and the well removed to a different pasture. Where the disease exists take the temperature of all animals night and morning and make a diagnosis of anthrax in all that have a fever.

13. Treatment --Anti-anthrax serum has proved to be successful in the treatment of anthrax in both animals and man.